

Letters to the editor

## Sleep science in the courtroom

To the Editor,

**Re: Ebrahim IO. Somnambulistic Sexual Behaviour (Sexsomnia). Journal of Forensic and Legal Medicine (Formerly Journal of Clinical Forensic Medicine) 2006;13:219–224**

Sexual behavior during sleep is a well-established variant of sleepwalking. Based on the case history provided in the above article the defendant in this rape case may have been in a somnambulistic state at the time of his crime. However, this article contains numerous misstatements regarding sleepwalking and in particular the methods for evaluation of sleepwalking in diagnostic or forensic settings. Additional, many of these misstatements are associated with incorrect or improper citations of the sleep science literature. In several instances statements improperly suggest that the described diagnostic techniques are powerful and generally accepted state of the art methods for objectively proving defendants to be sleepwalkers.

We feel compelled to write to correct these misstatements so your readership will not be misinformed and future defendants can receive proper evaluations and trials.

1. Page 20, 1st column, line 19 “*A sleepwalking episode is known as a sleep transition disorder because the episode occurs when the brain is switching over from deep slow wave sleep to REM sleep.*” This is an incorrect statement. The sleep literature reports a single episode in which this occurred. It is settled science for more than 40 years that sleepwalking always occurs following an incomplete arousal from deep sleep and more rarely from stage 2 sleep. Sleepwalking has been considered a “Disorder of Arousal” since 1969.
2. Page 20, 1st column, line 34: “*Rarely it can appear for the first time in childhood, frequently in relation to medication, alcohol or physical illness or in the presence of other psychiatric or neurological illness.*” The sleep literature suggests the opposite is correct. Sleepwalking can

certainly appear for the first time in adulthood and is noted to appear rarely in association with medication or alcohol. Sleepwalking has been reported to occur very rarely in association with fever (7 cases total), but never with physical illness. Sleepwalking is not a common symptom of either neurological or psychiatric disorders. Current estimates of sleepwalking in adults are 4%, not 1% or 2%.

3. Page 221, 1st column, line 19: “*With high alcohol blood levels, some confusional behaviour on awakening might be expected*”. The effect of high blood alcohol levels on sleepwalkers has never been studied in the sleep laboratory. No other type of controlled experimental research on this topic has been conducted. There is no evidence that high blood alcohol levels can result in sleepwalking and that defendants with high BACs are anything other than severely intoxicated.
4. Page 221, 1st column, line 21. “*Other risk factors for sleep-related automatisms...*” None of the so-called “risk factors” in this list are generally accepted as risk factors or symptoms of sleepwalking. None of these factors have been verified by sleep laboratory studies. All have been briefly mentioned as occurring in a limited number of individuals interviewed by phone or in case reports who may or may not have had bonefide sleepwalking or related disorders. As diagnostic factors they lack proven reliability, validity, reproducibility, sensitivity and specificity and will not be found in any published list of sleepwalker’s characteristics.
5. Page 221, 1st column, line 13 from bottom: “*Late onset sleepwalking is rare...*” As noted above this statement is no longer considered state of art in sleep medicine. Additionally, we are unaware of any bonefide cases of sleepwalking that have followed head trauma.
6. Page 222, 1st column, line 25: “*... common provocative maneuvers include alcohol ingestion prior to the sleep study.*”  
Page 222, 1st column, Line 29: “*Internationally accepted criteria for these studies are utilized*”. To our knowledge, the author and his collaborators are the only people in the world to make use of the “Alcohol Provocation Procedure”. It most certainly is not common.

DOI of original article: 10.1016/j.jflm.2006.12.003, 10.1016/j.jflm.2006.12.002, 10.1016/j.jflm.2006.12.001.

It appears to have been invented by the author expressly for use in criminal cases. It has never received any type of experimental validation or verification. The tests reliability, validity, reproducibility, sensitivity and specificity are unknown. It has never been directly tested using patients who are known to be sleepwalkers. It has never been tested in any other group of patients or in normal controls. Further, in the forensic cases in which it has been employed by the author; no complex behaviors have been provoked. The statement regarding this technique that *“internationally accepted criteria for these studies was used. . .”* is baseless. As noted above this technique is not used by anyone but the author. There are no published internationally accepted criteria and for that matter, no published data on this technique whatsoever. The authors attempted to establish the scientific validity of this statement by providing an improper reference (#19). The reference to the Rechtschaffen and Kales Sleep Scoring Manual is extremely misleading. This manual was published in 1969 and provides rules for analyzing sleep stages in normal adults. All sleep studies of all types for the last 40+ years have used this method. A sleep study cannot be analyzed without it. This manual does not mention the word sleepwalking or alcohol. It does not mention any criteria for diagnostic or forensic sleep testing whatsoever. Indeed, it was published more than 30 years before the first mention of “Alcohol Challenge Test”.

7. Page 222, 1st column, 22 lines from bottom: *“The following findings indicate a higher likelihood for Sleepwalking”*. The three sections following this statement purport to describe which findings during a baseline sleep study are consistent with sleepwalking. The state of the art in this area is that nothing short of the appearance of sleepwalking itself or a related complex behavior during deep sleep is consistent with sleepwalking.

Paragraph starting with Line 19 from bottom:

This paragraph suggests that arousals from stages 3 and 4 sleep are more common in sleepwalkers. Published research suggests that arousals are statistically more common in sleepwalkers compared to normal controls. Although statistically significant this finding has not been found to be clinically significant. Firstly, the number of arousals from stages 3 and 4 was quite variable from study to study. Secondly, the reported number of arousals overlaps between sleepwalking and normal groups. Thus, there is no clear cut-off point. Thirdly, frequent arousals from deep sleep are a common finding in many other sleep disorders such as sleep apnea and periodic leg movements in sleep. Thus, the number of arousals lacks specificity and cannot be used to prove the defendant is a sleepwalker. Fourthly, frequent arousals from sleep are common in current and former alcohol abusers and of no use in evaluating supposed alcohol related sleepwalking. Many studies are able to demon-

strate statistical significance, but very few become diagnostic tests.

Line 11 from Bottom: *“An AI greater than or equal to 15 is considered excessive”*.

This arousal index (AI) described by the author as “excessive” appears nowhere in the sleepwalking literature. As noted above, there is no particular cut-off value that is accepted as “excessive”. The author thus apparently incorporated this value of 15 without any support from the scientific literature. An apnea/hypopnea index (AHI) of 15/h of sleep is often used to describe a patient with clinically significant sleep apnea. However, this has no relationship to the diagnosis of sleepwalking.

Paragraph Starting with Line 10 from bottom: *“The appearance of a particular type of arousal indicates a higher likelihood of sleepwalking. . .”*.

The presence of hypersynchronous delta waves in sleepwalkers is a classic finding, but has not been accepted in the sleep medicine field as diagnostic since at least 1996. The author correctly cites Blatt et al (Ref. #13) as a classic article in this area. However, this study was performed in 1991 and has been superseded by many studies since that time. Two of the authors of this letter (CHS and MWM) published a detailed study in 1996 that reported that hypersynchronous delta waves precede only 15.5% of all arousals from deep or complex behaviors in known adult sleepwalkers. Thus, the sensitivity of this measure is very low. The other author of this letter (MRP) published a study in 2004 in which it was demonstrated that this pattern could be found commonly in patients who had no history of sleepwalking or related disorders. Thus, this measure lacks specificity as well.

Despite acknowledging these studies and their significance the author continues on to write:

*“Despite the controversy, most sleep experts agree that these EEG events remain a useful indicator of electrophysiological instability in stage 4 sleep.”* In support of this statement he cites reference #9 and 14. The author himself is the first author of reference #9, a review that uses identical language. Two of the authors of this letter (CS and MM) are the authors of the second reference. Secondly, as noted earlier in this letter nothing in reference #14 supports this statement and the authors disagree completely with this statement.

Page 222 2nd column, line 11 from top. *“Lower levels of slow-wave activity. . .”*

This statement is not referenced. However, the authors of one of the leading research articles on this topic wrote in the body of their article the following:

*“Given the likelihood that our results could be used in medico-legal settings, it is worth noting that the presence or absence of a decrease of the SWA early in the night and of awakenings from SWS in a given individual does not conclusively establish or refute a tendency toward sleep walking”*. (Gadreau H, Joncas S, Zadra A, Montplaisir J. Dynamics of slow-wave activity during the NREM sleep of sleepwalkers and control subjects. Sleep 2000;23:755–760)

Page 222, Column 2, Line 19:

The author incorrectly asserts that

1. *“...several provocative tests are often able to stimulate an episode of somnambulism.”*
2. *“More recently the use of sleep deprivation or alcohol challenge prior to the overnight study has become a popular method.”*

Firstly, no provocative test is currently accepted for the diagnosis of sleepwalking. Several research studies have examined the value of sleep depriving sleepwalkers prior to sleep studies. However, the results of these studies are contradictory with at least one major study reporting that sleep deprivation resulted in a decrease in sleepwalking and related behaviors. These studies remain of research interest only and are not used for diagnostic purposes.

Secondly, as noted above, the author is the only person to use “alcohol challenge” to provoke sleepwalking. It is not “popular” and to our knowledge has never produced a single sleepwalking episode in the sleep laboratory. The author again cites his own review article that contains no experimental data to substantiate his claims.

Page 222, Column 2, line 14 from bottom: *“Most studies report a dose dependent suppression of dreaming (REM) sleep and increased deep sleep in the first half of the night...”*

The sleep and alcohol literature show that some, but not all studies have reported an increase in deep sleep following administration of lower levels of alcohol in otherwise sober individuals. This statement does not apply to binge drinkers, alcoholics or former alcoholics. The sleep and alcohol literature reports dramatic declines in deep sleep in these patients that would be inconsistent with the appearance of sleepwalking.

Page 222, Column 2, line 10 from bottom: *“If a sleepwalking episode occurs after consumption of alcohol, then the episode is likely to be more complex, confusional and the individual less likely to remember the event the following morning.”*

This statement has no basis in the sleep medicine literature and is not accepted by sleep specialists. The author provides a reference (#17) to an abstract presented at the 2000 meeting of the Association of Professional Sleep Societies. However, this abstract makes no mention of an Alcohol Provocation Test whatsoever. In fact the word “alcohol” does not appear. In the later full report of this research by Dr. Joncas and colleagues there is also no mention of alcohol or Alcohol Provocation Test to be found.

Page 223, 1st column, line 19 from bottom: As part of the summary of the evidence in favor of a diagnosis of sleepwalking the author notes the following factors:

1. *“He showed all the features indicating a tendency to sleepwalk...”*
  - *“Increased Arousal Index (AI) on all three nights of PSG recordings.”*

- *“HSDWA and DWC.”*
- *“The alcohol challenge study showed a characteristic pattern of a fragmented first Slow Wave Sleep (SWS) cycle with multiple HSDWA arousals and lower SWS in the first sleep cycle.”*

As noted above none of these “features” indicate a tendency to sleepwalk. In particular the so-called “Alcohol Provocation Test” has never been tested in any fashion before use in forensic cases. If a diagnostic test has never been tested in the sleep laboratory on normal controls or patients how can it be said that a finding is typical or atypical?

It should be further understood that sleep studies conducted months or years after the date of the criminal action cannot provide any data on whether or not the defendant was in a somnambulistic state at the time of the rape. Even if an actual sleepwalking episode were to be captured during a sleep study performed after the event, the fact that 4% of adults will occasionally experience sleepwalking invalidates the assumption that because sleepwalking was recorded in the sleep laboratory, sleepwalking was also occurring during the event in question. The sleep laboratory sleepwalking episode could clearly be coincidental or even the result of malingering.

In summary, we do not dispute the diagnosis of the defendant with Sexual Behavior in Sleep based on the clinical history provided. However, this article contains a very disturbing number of misstatements and incorrect scientific citations. Additionally, the author has misrepresented the reliability, validity, sensitivity, specificity and general acceptance of his techniques. It is our opinion that errors made in the article are too extensive to be corrected by author. The information provided in the article will provide your subscribers and readers with a false impression of the current practice and state of the art of sleep medicine. Additionally, it may influence improperly the conduct of future criminal evaluations and trials. For this reason, we respectively suggest and request that the article be withdrawn.

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## Author's response

Dr. Payne-James

**Re: Ebrahim IO. Somnambulistic Sexual Behaviour (Sex somnia). Journal of Forensic and Legal Medicine (Formerly Journal of Clinical Forensic Medicine) 2006;13:219–224**

Thank you for forwarding to me a letter from Dr Pressman and Colleagues (Pressman & Co.) regarding the article listed above. I have reviewed the letter and as requested, I am submitting my response below.

### Background

As you mention in your email, the article was published in a special edition of the *Journal of Clinical Forensic Medicine* (JCFM) earlier this year. The article is a Case Report and was subject to the journal's limits on length and number of references. As such, it was not the primary intention of the article to provide a detailed review of the area concerned, rather to provide “one or two related cases with specific unambiguous message that needs little discussion, small number of references” (this statement is taken from The Guidelines to Authors from the JCFM). In addition, the case report underwent peer review and was subject to revisions prior to publication as is standard practice for scientific journals. In assessing my response to the letter by Pressman & Co, I have re-examined my original and revised manuscripts, the reviewers' comments, my final submitted manuscript and the published article.

I will now deal with the specific comments by Pressman & Co:

### Statement 1

Whilst I agree that the initial statement is an older definition, the paragraph continues and states clearly:

*The most commonly implicated sleep disorders associated with automatism are the Parasomnias of which the Disorders of Arousal are the most common. These include sleepwalking disorder.*

There is thus no basis for Pressman's statement that “... It was not stated that it was a disorder of arousal.” It was stated in the article that sleepwalking was a sleep transition disorder. It is interesting how old science becomes new science. A transition disorder suggests that sleepwalking always arises from an arousal, with the implication that the arousal is external. Current views of sleep physiology suggest that we do not yet understand the arousal mechanism, and it is far too early to suggest that all arousals for sleepwalking are external. For example, there is an excellent review by Colrain (Colrain IM. The K-complex: a 7-decade history. *Sleep* 2005;28:255–73.).

### Statement 2

The article clearly and unambiguously states that “Rarely, it can appear for the first time in ADULTHOOD (my capitalisation)

**The authors of the letter have clearly not read the paper properly as they have misread this sentence in which they confuse childhood with adulthood.** Since the authors then elaborate on this reading error it raises the question of whether all the signatories actually read the article before signing the letter. One would have expected at least one of them to have picked up such an elementary error in their letter. In the same paragraph the writers note that they are aware of only seven cases in total where sleepwalking occurs in association with pyrexial illnesses. It is a

DOI of original article: 10.1016/j.jflm.2006.12.004, 10.1016/j.jflm.2006.12.002, 10.1016/j.jflm.2006.12.001.